

Remarks

I. 35 USC 103

A. Claims 1-13

The Office Action states:

Claims 1-10 and 12-13 are rejected under 35 USC 103(a) as being unpatentable over U.S. Patent No. 6,515,895 to Naji in view of Saito et al. and further in view of the remark.

The Office Action does not give the patent number for “Saito et al.” and so applicants assume that “Saito et al.” refers to U.S. Patent No. 6,522,573, which is listed in the Notice of References cited by the Examiner.

The Office Action continues:

Regarding to claim 1, Naji discloses a device comprising a first electrode 11 having a magnetic moment with a direction that is substantially fixed in response to an applied magnetic field; a second electrode 12 having a magnetic moment with a direction that is variable in response to the applied magnetic field; and a tunnel barrier layer 14 separating the first and second electrodes. Naji does not disclose the tunnel barrier layer including a substantially homogenous, primarily dielectric material including a ferromagnetic element in an atomic concentration of less than five percent.

The Office Action further states:

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the tunnel barrier layer including a substantially homogenous, primarily dielectric material including a ferromagnetic element in an atomic concentration of less than five percent, since it has been held that where general conditions of a claim are disclosed in the prior art, discovering optimum or working ranges involves only routine skill in the art.

Applicants respectfully assert that the Office Action does not present a prima facie case of obviousness.

The Office Action admits that: “Naji does not disclose the tunnel barrier layer including a substantially homogenous, primarily dielectric material including a ferromagnetic element in an atomic concentration of less than five percent.”

The Office Action does not point to any disclosure in Saito et al. that teaches or suggests this limitation. Applicants have reviewed and Saito et al. and respectfully assert

that Saito et al. does not that teach or suggest “a tunnel barrier layer ...including a substantially homogenous, primarily dielectric material including a ferromagnetic element.” Applicants further respectfully assert that Saito et al. does not that teach or suggest such “a ferromagnetic element in an atomic concentration of less than five percent.” For these reasons, claims 1-13 are not obvious over the cited references.

The Office Action further states:

Regarding to claim 4, the device wherein the tunnel barrier layer includes atoms of aluminum, cobalt and silicon (Naji col.2, lines 26-28, Saito: col. 11, lines 50-55).

Applicants have reviewed the cited references, and especially reviewed the lines cited by the Office Action, and respectfully assert that neither Naji nor Saito et al. teach or suggest the “tunnel barrier layer includes atoms of aluminum, cobalt and silicon.”

The Office Action continues:

Regarding to claim 5, the device wherein the tunnel barrier layer includes atoms of aluminum and iron (Naji col.2, lines 26-28, Saito: col. 11, lines 50-55).

Applicants have reviewed the cited references, and especially reviewed the lines cited by the Office Action, and respectfully assert that neither Naji nor Saito et al. teach or suggest the “tunnel barrier layer includes atoms of aluminum and iron.”

The Office Action also states:

Regarding to claim 6, the device wherein the tunnel barrier layer includes atoms of aluminum, iron and silicon (Naji col.2, lines 26-28, Saito: col. 11, lines 50-55).

Applicants have reviewed the cited references, and especially reviewed the lines cited by the Office Action, and respectfully assert that neither Naji nor Saito et al. teach or suggest the “tunnel barrier layer includes atoms of aluminum, iron and silicon.”

The Office Action then states:

Regarding to claim 7, the device wherein the tunnel barrier layer includes an oxidized alloy of aluminum (Naji col.2, lines 26-28, Saito: col. 11, lines 50-55).

Applicants have reviewed the cited references, and especially reviewed the lines cited by the Office Action, and respectfully assert that neither Naji nor Saito et al. teach

or suggest the “tunnel barrier layer includes an oxidized alloy of aluminum.”

The Office Action further states:

Regarding to claim 8, the device wherein the tunnel barrier layer includes a nitridized alloy of aluminum (Naji col.2, lines 26-28, Saito: col. 11, lines 50-55).

Applicants have reviewed the cited references, and especially reviewed the lines cited by the Office Action, and respectfully assert that neither Naji nor Saito et al. teach or suggest the “tunnel barrier layer includes a nitridized alloy of aluminum.”

The Office Action further states:

Regarding to claim 9, the device wherein the tunnel barrier layer includes a nitridized alloy of aluminum, and the alloy is a single phase solid at 600 °C (Naji col.2, lines 26-28, Saito: col. 11, lines 50-55).

Applicants have reviewed the cited references, and especially reviewed the lines cited by the Office Action, and respectfully assert that neither Naji nor Saito et al. teach or suggest the “tunnel barrier layer includes a nitridized alloy of aluminum.”

The Office Action continues:

Claim 11 is rejected under 35 USC 103(a) as being unpatentable over U.S. Patent No. 6,515,895 to Naji in view of Saito et al. (6,522,573) and further in view of Gill (6,437,275).

Regarding to claim 11, Naji in view of Saito discloses the claimed invention except for the device wherein the second electrode has an easy axis of magnetization that is substantially perpendicular to the magnetic direction of the first electrode.

Applicants respectfully disagree with this assertion, as discussed above with respect to claim 1. Applicants have reviewed Gill, and respectfully assert that Gill does not overcome the deficiencies of the obviousness rejection.

In summary, the Office Action does not provide a prima facie case of obviousness of claims 1-13.

B. Claims 14-25

The Office Action states:

Claims 14-25 are rejected under 35 USC 103(a) as being unpatentable over U.S. Patent No. 6,515,895 to Naji in view of Saito et al.

Regarding to claim 14, Naji discloses a device comprising a first ferromagnetic layer 11 having a magnetic moment with a direction that is substantially fixed in response to an applied magnetic field; a second ferromagnetic layer 12 having a magnetic moment with a direction that is variable in response to the applied magnetic field; and a dielectric layer 14 separating the first and second ferromagnetic layers.

The Office Action admits:

Naji does not disclose the dielectric layer having a thickness of less than three nanometers, the dielectric layer including a ferromagnetic element substantially uniformly dispersed in the dielectric layer at an atomic concentration of less than about five percent.

The Office Action states, however:

Saito teaches the dielectric layer having a thickness of less than three nanometers as set forth in col. 11, lines 1-4.

Applicants have reviewed column 11, lines 1-4 of Saito et al. that are cited by the Office Action, and respectfully assert that Saito et al. do not mention a dielectric layer in those lines.

The Office Action further states:

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the dielectric layer having a thickness of less than three nanometers, the dielectric layer including a ferromagnetic element substantially uniformly dispersed in the dielectric layer at an atomic concentration of less than about five percent, as taught by Saito et al. in order to enable a higher capacity, to assure high reliability, and to have a high yield (col. 2, lines 54-56).

The Office Action has not shown that Saito et al. teach a dielectric layer having a thickness of less than three nanometers, or a dielectric layer including a ferromagnetic element substantially uniformly dispersed in the dielectric layer at an atomic concentration of less than about five percent.

There is also no incentive to combine those elements that are absent from the cited references.

For at least these reasons, claims 14-25 are not obvious over the cited references.

C. Claims 26-37

The Office Action states:

Claims 26-37 are rejected under 35 USC 103(a) as being unpatentable over U.S. Patent No. 6,515,895 to Naji in view of Saito et al. and further in view of the remark.

Regarding to claim 26, Naji discloses a device comprising a first electrode including a first magnetic layer 11 having a magnetic moment with a direction that is substantially fixed in response to an applied magnetic field; a second electrode including a second magnetic layer 12 having a magnetic moment with a direction that is variable in response to the applied magnetic field; and a dielectric layer 14 separating the first and second magnetic layers.

The Office Action admits:

Naji does not disclose the dielectric layer having a thickness of less than five nanometers and containing a magnetic element substantially uniformly dispersed in an atomic concentration of less than about five percent; wherein an electrical current between the electrodes depends upon an orientation of the second magnetic moment relative to that of the first magnetic moment.

The Office Action states, however:

Saito teaches the dielectric layer having a thickness of less than five nanometers as set forth in col. 11, lines 1-4.

Applicants have reviewed column 11, lines 1-4 of Saito et al. that are cited by the Office Action, and respectfully assert that Saito et al. do not mention a dielectric layer in those lines.

The Office Action further states:

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the dielectric layer having a thickness of less than five nanometers, the dielectric layer including a ferromagnetic element substantially uniformly dispersed in the dielectric layer at an atomic concentration of less than about five percent, as taught by Saito et al. in order to enable a higher capacity, to assure high reliability, and to have a high yield (col. 2, lines 54-56).

The Office Action has not shown that Saito et al. teach a dielectric layer having a thickness of less than five nanometers, or a dielectric layer including a ferromagnetic element substantially uniformly dispersed in the dielectric layer at an atomic concentration of less than about five percent.

There is also no incentive to combine the elements that are absent from the cited references.

For at least these reasons, claims 26-37 are not obvious over the cited references.

II. Conclusion

Applicants have responded to the Office Action by showing that the Office Action has not presented a prima facie case of obviousness for any of the claims. As such, applicants respectfully assert that the application is in condition for allowance, and a notice of allowance is solicited.


Applicants' attorney respectfully requests a telephone interview with the Examiner to discuss this application. Please call the undersigned at the number below to set up an interview at the Examiner's convenience. Thank you.

Respectfully submitted,


CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on October 14, 2003.

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